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ABSTRACT

At the end of the 1992-93 school year, Dutch schools finished their preparations for a new core curriculum for the first stage of secondary education. One of the problems teachers faced in implementing this curriculum was the problem of class heterogeneity. How teachers dealt with heterogeneity was studied through an examination of the use of academic learning time by 25 teachers and their students from 3 secondary schools in English, Dutch, and mathematics courses. Fifteen teachers participated in both study years; 10 were replaced after the first year. The schools differed in the way that they formed classes--heterogeneous, homogenous, or "tiled" (composed of overlapping layers of abilities). Results showed that decisions concerning classroom composition were related to particular preferred learning environments, ranging from "whole-class" in homogeneous classes to individualized settings in heterogeneous classes. Time-on-task levels were found to be higher in homogeneous than in heterogeneous classes, and an interaction effect between ability level and classroom heterogeneity was found for time-on-task during seatwork. Well-known measures for adapting instruction to individual students' needs were not clearly visible. (Contains 5 tables, 2 figures, and 24 references.) (SLD)

CLASS HETEROGENEITY & ADAPTIVE TEACHING IN DUTCH SECONDARY EDUCATION

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Class heterogeneity and adaptive teaching in Dutch secondary education

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Abstract

At the end of the school year 1992-1993 Dutch schools finished their last preparations before implementing a new core curriculum for the first stage of secondary education, starting the next school year. One of the problems which teachers have to face and deal with is the problem of class heterogeneity. To gain insight into the ways this problem was dealt with in the course of the innovation, the use of academic learning time was selected as a research subject. Twenty-five teachers and their pupils from three secondary schools were selected for observations in English, Dutch and math lessons. Fifteen of these participated during two school years. Ten teachers had to be replaced in the second school year after terminating their participation in the study.

The schools differed in the way they form classes: homogeneous, heterogeneous, or so called tiles-classes. The results show that decisions concerning classroom composition appear to relate to particular, preferred learning environments, ranging from "whole-class" in homogenous classes to "individualized" settings in heterogeneous classes. This picture remains stable over the two school years. Time-on- task levels were found to be higher in homogeneous than in heterogeneous classes, especially during individual seatwork. In addition, an interaction effect between ability level and classroom heterogeneity was found for time-on-task during seatwork.

Time-on-task levels are lower during teacher-led activities than in individualized settings. Finally, well-known measures for adapting instruction to individual students' needs are not clearly visible, although teachers used enhancement and augmentative tasks in the second school year.

1. Class heterogeneity in Dutch secondary education

At the start of the school year 1993-1994 a major innovation was implemented at the first stage of Dutch secondary education. All students were to be educated according to a core curriculum containing common objectives for 15 subjects and were given two to four years to reach these objectives. In the second stage students were to be reallocated to various levels leading to different certificates for different streams. This meant that schools and teachers could set out an individual learning route for each student. In other words, what the educators were asked to do was apply adaptive teaching.

However, in addition to other factors, it is the classroom context that determines the way such adaptations are carried out. One major problem now facing Dutch secondary teachers is classroom distribution. Should students be assigned to homogeneous first-stage classes, to heterogeneous classes, or to mixed classes? Most Dutch schools base their placement-policy on the advice of the primary school principal. This advice concerns the final stream that should be selected for each student in the second stage. Whereas homogeneous classes contain students expected to be in the same second-stage stream, heterogeneous classes contain students who may be in totally different streams. Finally, students

whose advice involves adjacent streams are assigned to so called tile-classrooms.

We may assume that heterogeneity influences the successful adaptation of instruction by the teacher to the individual needs of the student. Our aim is to gain insight into the facilitating and inhibiting factors of adaptive teaching during the first-stage of secondary education. We are especially interested in the influence of class heterogeneity on the adaptability of teaching during the course of implementation of the innovation. This paper describes the results of two school years: 1992-1993, the year before the start of the innovation, and 1993-1994, the first year of implementation.

2. Class heterogeneity, teaching and learning

A good deal of research on class heterogeneity has focused on the effects of ability grouping and models of differentiation (Kulik & Kulik, 1982; Slavin, 1990). From the results of this research we might conclude that effects of differentiation cannot be interpreted in a straightforward manner. Context factors such as class-size, level of achievement. and socio-economic status play an important role, as does actual teaching behavior. In many Dutch studies actual classroom behavior is often either ignored or assessed by means of questionnaires. By contrast, the present study focuses on teaching and learning processes as observed in the classroom.

The way in which students and teachers use their available academic time for learning or instruction plays a central role. In our view, an important condition for adaptive teaching is the productive use of academic learning time. Several reviewers point out that the use of instructional time and students time-on-task levels, are important for academic learning (Walberg, 1986, 1988; Fraser, Walberg, Welch & Hattie, 1987; Wang, Haertel & Walberg, 1993). The loss of academic learning time seems to be an important problem in heterogeneous classes.

Class heterogeneity - which is usually manifested in the level and the distribution of entry characteristics such as prior knowledge, performance levels or advice concerning further education - can effect students' time-on-task behavior. Evertson, Stanford and Emmer (1981) found that the higher the degree of class-heterogeneity in secondary education, the smaller the degree of on task behavior of the students. Time is wasted in the preparation or continuation of tasks, as well as in the waiting for help from fellow-students or the teacher, or in non-engagement in current tasks.

Research in Dutch elementary schools has partly confirmed these findings. In classes which are heterogeneous as regards age (mixed-age classes) task-oriented learning time turns out to be under greater pressure than in classes with homogeneous compositions as regards age (Veenman, Lem, Winkelmolen, Voeten & Lassche (1986); Lem, Veenman, Nijssen & Roelofs, 1988; Roelofs, 1993). Students in mixed-age classes are somewhat more often engaged in non-assigned tasks and have a greater tendency to idleness after task-completion. It is striking that the percentages of time-on-task in mixed-age classes vary greatly, from 50% to 90%.

By contrast, Schonewille (1988, 1993) reports that it is the homogeneous classes at LOM schools (a form of special education) that show a lower degree of time-on-task than the heterogeneous equivalents. Pupils at LOM schools are obliged to wait longer and more often for the teacher's help and are more often procedurally engaged. These different findings are possibly connected with the special characteristics of the group of students studied.

As indicated, there are no data available concerning the effects of heterogeneity on

time-on-task levels in Dutch secondary education. There is a report by Herfs, Mertens, Perregenet and Terwel (1990) which indicates a general average of 78% for first-stage classes of secondary education. It is notable that here too the differences between classes were considerable, between 50% and 95%, although these differences are not related to heterogeneity by the authors.

In studying the effects of heterogeneity in general elementary education the position of high achievers and low achievers is important. The Dutch observation studies carried out by Veenman et al. (1986) for mixed-age classes show that both high and low-achieving pupils are less task-oriented than their fellow-students in single-age classes. This difference shows up particularly clearly during the periods in which the pupils work individually. The investigators conclude that adjustment of instruction and supervision for mixed-age groups causes more problems than for single-age groups.

The reported difference need not necessarily be a consequence of heterogeneity, but could also be connected with selection procedures. For example, Reezigt, De Vries and Weide (1988) found that low-achieving pupils in mixed-ability classes attain a much lower percentage of time-on-task (58%) than comparable pupils in classes in which homogeneity for the whole class was maintained (68%). In addition, the time-on-task rates of pupils of different levels in mixed-ability classes was higher than in the other classes.

The question we now have to address is: What are the effects of heterogeneity on teacher behavior? One consistent fact in learning-time research is the considerable variation in on-task behavior between classes. Obviously, some teachers are more able to let their students work in task-oriented ways than others.

An important cause of loss of academic learning-time is the lack of adaptation to students' specific needs. In heterogeneous classes teachers experience greater difficulties in choosing topics for the lessons that are appropriate for the backgrounds of the students, as well as in assigning tasks and materials that follow logically from instruction. In other words, adapting to students' needs calls for well-developed instructional skills. In addition, heterogeneous classes make greater demands on their teachers in terms of talent for classroom organization. American as well as Dutch studies have shown that heterogeneous classes with high levels of on-task behavior are well-organized and well-managed (Evertson, et al. 1981; Stallings, 1980; Roelofs, Raemaekers, & Veenman, 1991).

It should be pointed out that homogeneity is not necessarily a guarantee for improved adaptation of learning assignments. The performance average of a class is also an explanatory factor. As regards this latter factor Evertson (1980) found that teachers of homogeneous secondary-education classes with a preponderance of low achievers tended to offer their pupils fewer varied activities than teachers of homogeneous high-achiever classes. As a result the low achievers in the classes in question experienced more moments of inactivity than pupils in the latter type of class.

Information about the effects of heterogeneity on teacher behavior in Dutch secondary education is not available. There is a study by Van der Werf and Driessen (1993) based on questionnaires for the school year 1989-1990, which provides a *general* picture of the use of instruction time in first-stage secondary classes. The authors conclude that "[...] teachers are mainly used to whole-class instruction according to the standard model: instruction, discussion of completed assignments, and letting pupils work on in-class (or homework) assignments [...]" (p.109). They also conclude that teachers take few initiatives in dealing with differences between pupils. According to Van der Werf and Driessen teachers hardly ever set minimum targets and use test-data more often as a means of communication with parents and pupils than as a source of information about their own

teaching. Where teachers do use a differentiation model it is usually of the 'basics, enrichment and revision' type. The researchers' conclusion expresses the fear that not all pupils will reach the core targets, because teachers are not used to dealing with differences between pupils.

3. Research questions.

Given this sombre conclusion on the one hand and the possible consequences of class-heterogeneity on the other, it is important to establish what it is that teachers in mixed junior high-school classes actually do and what the consequences of their behavior are for their pupils. We shall try to map this for the first stage of core-curriculum implementation, by means of a detailed analysis of teaching and learning behavior in the first two years of secondary education.

On the basis of the research published to date we may expect that the pressure on task-related behavior is proportional to the degree of class-heterogeneity. It should be noted in this connection that much depends on the teacher. If the teacher succeeds in adapting learning assignments to the level of the learner then the chance that learning will be task-oriented and successful will be relatively high.

In this paper we try to answer the following research questions:

1. a) How do teachers at large secondary schools spend their instructional time in terms of classroom-management actitivities and instructional activities?
   b) To what extent is the use of instructional time related to class-heterogeneity?
2. a) To what extent do students at these schools spend their academic time on task?
   b) Are time-on-task levels related to the settings in which learning activities take place?
   c) Do time-on-task levels differ with student ability levels?
   d) To what extent are time-on-task levels related to class-heterogeneity?
3. What measures do teachers take to adapt their instruction to different student ability-levels?
4. How do time-use and adaptive measures develop during two school years?

4.1 Instruments

Classroom observations

Observational data on teachers' use of instructional time and on pupils' time-on-task levels were collected by a 'predominant activity' time-sampling procedure (Tyler, 1979). To obtain this information a predetermined observational sequence was set up.
In each class, six students of three different levels of ability were selected for observation: low, middle and high. This selection was based on the results of two intelligence tests: one for verbal intelligence and one for spatial intelligence. The observer looked briefly at the behavior of the first student ('low'), then for seven seconds at the behavior of the teacher, and recorded the current responses for the next thirteen seconds. The observer subsequently switched attention to the next student ('middle') and to the teacher. The same procedure was repeated for the third student ('high'). After observing all six students the observer resumed the observational procedure for student no.1. Each period of observation lasted approximately 40 minutes, depending on the time table. The observations were carried out with the use of computer-scanning forms. An observation-timer emitted two optical and

auditive signals; one to indicate the start of an observation period and one at the start of a coding period.

The observers recorded the following four pieces of information: a) the students' response to the task (e.g. on-task, off-task etc.); b) the students interaction source (e.g. teacher-individual, peer); c) the teacher's target group (e.g. whole class, group, individual student); d) the task-related activities of the teacher (e.g. instruction of new knowledge, supervision, guided practice); and e) the settings in which the observed student was working (e.g. whole class, group work, seatwork).
The observation instrument included 24 categories.The most important observational variables for the purposes of this paper are listed in Table 2.

Prior to the collection of observational data, the six observers completed a 40-hour training program. Inter-observer reliability checks, using Cohen's kappa's ranged from 0.64 to 0.97 (mean: 0.76). All classrooms were visited at different times by different observers to control for observer effects.

Questionnaires

The way in which teachers attempt to adapt their instruction to different student ability levels was assessed by means of a two-part questionnaire. In the first part the teacher answered three questions about the six selected students. Two of these questions were repeated in all three observations. First the teacher was asked about the amount of instructional time spent on specific students, compared with other students. In addition, teachers were asked at the end of every observed period to rate on a five-point scale the difficulty and the routine-like nature of the academic tasks used in this specific period.

In the second section of the questionnaire teachers were asked to respond to more general questions concerning the way they dealt with heterogeneity. The following topics were covered: the number of students with serious problems in carrying out tasks; the estimated amount of time allocated to low achievers; the amount of time lost waiting for low achievers; ways of grouping students; the number of students working on enrichment tasks; the way records of student progress were kept by teachers; the perceived ability in adapting instruction to students' needs, the need for special attention to poor learners, the possibilities for high achievers to help their less able peers, and organizational contraints regarding the adaptation of instruction.

4.2 Data collection and analysis

The observational data for each observation period, collected through time-sampling, were expressed in percentages of instructional periods. Next, the pupil and teacher behaviors within each category of the instrument were averaged to produce for each observation the means-per-category for each class and teacher. Finally, the observations in each subject area, namely Dutch, English, and mathematics, were collapsed to produce mean rates for each of the observation periods 1992-1993 and 1993-1994. It was recognized that the observational variables were not independent of each other: coding an event as one category excludes all other categories in the same time-interval.

The use of instructional time and academic learning-time was analyzed by means of descriptive statistics. Analyses of variance were applied to check for cross-sectional differences in the use of time (between schools, between subjects). An analysis of changes over two school years by means of a repeated-measures design was considered, but as a

result of subject loss (teachers moving to different grades, illness, problems with being the object of observation), the data were analyzed in a cross-sectional way. However, the results were controlled for the effects of subject loss by comparing the results of 'stayers' with those of 'leavers' and 'newcomers'. Leavers are those who left the sample after the first school year, newcomers those who participate in observations from the start of the second school year.

4.3 Subjects: teachers and students

The study into ways of dealing with heterogeneity is part of a longitudinal case-study, in which the implementation of the core curriculum is the focus. It concerns the processes of implementation on school- and class-level and the effects on teachers and students. For the purpose of the case study and in order to make differences in the implementation process visible three what are called 'broad-based combined schools' were selected with clearly different ideological bases. A broad-based combined school is a school in which all strands of secondary education are represented: a department for pre-vocational education, junior general secondary education, senior general secondary education, and pre-university education.

Apart from these broad-based schools there are also what are called 'categorial' or single-based schools, in which only one strand is represented or schools which consist of two or three schools under one roof. These latter types of schools were not selected since the phenomena for study are less obviously present, such as structures for the coordination of change-processes.

4.3.1 General characteristics of the participating schools

School A.

School A is a broad-based state school for secondary education, which was founded in 1983 and has five streams in the second stage: junior pre-vocational, pre-vocational, junior general secondary, senior general secondary, and pre-university education. The school employs 100 teachers, 5 members of the management team and 20 support staff (including technical and administrative staff). The school is situated in a socially deprived area with many problems. It contains a relatively high concentration of ethnic minority students (10%). The students are grouped into completely heterogeneous classes at the first stage. The working relations between staff are cordial. The expectation concerning the core curriculum is that it could possibly be a retrograde step. The fear is that it will imply less choice in the structure of education, as a result of which weaker students could be disadvantaged.

School B.

School B is a Roman Catholic combined-school with five ability streams: individualized junior secondary home economics, junior secondary home economics, junior general secondary, senior general secondary and pre-university education. The school was founded in 1985 as an amalgamation of two schools, and employs some 75 teachers, six management staff and 12 support staff. The effects of amalgamation are still noticeable. There is a split in the teaching staff which mirrors the component categorial schools from the village

and the neighboring city. The student population is solely of Dutch origin. In the first year classes are composed according to the 'overlapping layers' or 'tiling' system. In spite of the effects of amalgamation the atmosphere in the school is mainly positive: there is room for individual initiative, working relations are cordial and attitudes relaxed. The core curriculum is regarded as an opportunity for further educational development.

School C.

School C is a combined protestant school with four streams: pre-vocational, junior general, senior general and pre-university education. The ideological identity of the school was chosen deliberately and plays a decisive role in all facets of school life. Its identity is the main reason why parents choose the school. It also forms the basis for staffing policy. The school was founded in 1984 and has since grown rapidly to a total number of 1400 students. At the start of the 1994-1995 school year an annex was established with five first grades. In the school year 1992-1993 the school employed some 80 teacher, five management staff and 14 educational support staff. The school conveys an atmosphere of mutual respect and an awareness of power relations, and leaves room for individual initiatives and informal contacts. By and large the attitude towards the core curriculum is positive and sympathetic. There is much uncertainty about the structuring of the core curriculum and its consequences for education.

4.3.2 Characteristics of the participating classes and teachers.

In both school years 25 teachers of Dutch, English, and math, and a sample of their students participated in the study. Ten out of the '1992-1993 group' of teachers had to be replaced in the second school year for various reasons: promotion to a higher grade, illness, or problems with being the object of observation.

In school A all teachers (n=9, 8) taught heterogeneous classes, potentially with students from entirely different streams in the second stage of secondary education. In school B teachers (n=7, 7) took part who taught classes with overlapping layers of streams called 'tiled classes'. These classes contain students who received advice for adjacent streams.

At school C there occurred an unforeseen change in the situation during the second school year. In the school year 1992-1993, all nine teachers were in charge of homogeneous classes, with students expected to be from the same second stage stream. During the next school year however, there was a change in the policy concerning classroom composition. In this year, teachers (n=9) taught in 'partly tiled' classes, consisting of seperate 'pre-vocational' first stage-classes and 'tiled classes' (junior-senior general secondary and pre-university streams).)

In the 1992-1993 group, the mean age of teachers in school A was 34.3 years (Sd=7.2), in school B 37.2 years (Sd=3.8), and in school C 33.7 years (Sd=7.3). In the 1993-1994 group the mean ages were 33.3 years in school A (Sd=4.9), 38.6 years in school B (Sd=3.9, and 31.8 years in school C (Sd=8.6). In both school years teachers were observed during three periods on separate days (May-June 1993, 1994).
The selection of students for in-class observation was based on the results of two tests. The first of these is a frequently used Dutch test for verbal intelligence, the 'Word List' from the 'Differential Aptitude Test Series' by Evers & Lucassen (DAT, Evers & Lucassen, 1983), the second test was taken from the Raven Progressive Matrices for non-verbal

intelligence (Raven, 1965).

Students were categorized as 'low' (below 30th percentile on both tests), 'middle' (30th-67th percentile) or 'nigh ability' (above the 67th percentile), based on the test score distribution in their respective classes. Thus, a relative measure of ability was chosen, because this reflects the classroom reality that teachers face most adequately.

Table 1 contains some important features of the observed classes in 1992-1993. The results of the second school year are roughly equivalent to these results and need no futher comment.

We may conclude from this table that the differences in class heterogeneity, as defined by the schools, are well reflected in mean testscores and partly in the standard deviations. We assume therefore that differences in the advice of primary-school principals make up a valid indicator of class heterogeneity.

5. Results

Table 2 presents the general results of the classroom observations. Teachers' use of time and students' time-on-task levels are expressed as percentages of lesson periods. When we refer to differences in the subsequent discussion of the results, these differences are statistically significant at the .05 level. Differences in time-use between subjects will be mentioned, but these are not presented in tables.

Teacher activities

In essence teachers can spend their time on instructional or on management activities. They may also be involved in non-teaching activities. We shall start here with a description of the teachers' use of instructional time (involving the process of reviewing students' prior knowledge up to the teacher's monitoring and helping behavior).

A very small amount of time is used for *reviewing prior knowledge* (about 1% in both years). At school C significantly more time (2.3%, 1.2%) is spent on this activity than in schools A and B.

About a quarter of the lesson period is spent on *development of new knowledge and skills.* Development can take place through direct instruction or through guided discovery. In practice we often observed teachers reviewing homework in a whole-class setting. Again teachers at school C (homogenous groups) spent considerably more time on this activity than their colleagues at school A (heterogeneous) and B (mixed or 'tiled classes').

Guided (teacher led) practice takes up about 4% of the period, checking and testing of knowledge about 10%. By testing we mean here, checking students' knowledge by asking oral or written questions. The purpose of this activity is evaluation.

Students are rarely in control of their own learning activities. *Student- led activities* on average only take up 1% of a lesson period. Examples of student-led activities are student presentations, which may be followed by group or whole-class discussions.

Teachers spend about 30% of their instructional time on *monitoring seatwork activities and providing help* to students. Teachers at school A and B spent more time on this activity than teachers at school C.

Management activities take up about 20% of the lesson period. Examples of these activities are lesson transitions and activities aimed at restoring a smooth classroom climate (e.g. stopping disruptive behavior).

Table 1: Features of the observed classes during the first school year

	Class	Type of classroom	Class size	Raven		Vocabulary (DAT)	
				Mean	Sd	Mean	Sd
School A:			21.4	13.8	1.6	29.8	1.5
Dutch	A1	pre-voc through pre-uni	24	15.9	4.6	30.5	7.9
	A2	pre-voc through pre-uni	22	12.1	4.4	27.9	10.9
	A3	pre-voc through pre-uni	21	11.5	5.3	30.0	9.3
English	A4	pre-voc through pre-uni	23	15.3	5.6	30.5	9.7
	A5*	pre-voc through pre-uni	15	-	-	-	-
	A6	pre-voc through pre-uni	22	14.6	4.6	31.7	9.2
Math	A7*	pre-voc through pre-uni	20	-	-	-	-
	A8	pre-voc through pre-uni	23	13.8	4.9	30.2	8.8
	A9	pre-voc through pre-uni	23	13.3	6.5	27.6	6.5
School B:			22.9	14.8	1.4	31.2	6.4
Dutch	B1	jun. general/senior general	24	15.0	4.7	32.1	8.0
	B2	senior general/pre-uni	24	13.6	3.3	38.0	6.6
English	B3	pre-voc/jun. general	20	14.0	3.5	21.4	8.2
	B4	jun. general/senior general	22	15.1	3.6	28.2	5.2
	B5	senior general/pre-uni	25	17.3	4.0	39.7	10.5
Math	B6	pre-voc/jun. general	22	13.2	3.9	26.7	4.5
	B7	jun. general/senior general	23	15.3	4.1	32.0	6.4
School C:			27.7	12.1	1.0	30.7	9.5
Dutch	C1	pre-voc	26	12.1	3.8	22.9	8.0
	C2	jun. general	28	10.9	3.1	34.3	8.0
	C3	jun. general	27	11.2	3.0	33.0	6.9
English	C4	pre-voc	28	10.4	4.2	18.0	4.4
	C5	jun. general	27	10.5	2.4	32.6	7.4
	C6	pre-uni	30	16.7	4.4	46.7	6.7
Math	C7	pre-voc	27	12.9	4.5	28.8	6.3
	C8	pre-voc	27	10.8	3.6	19.3	8.0
	C9	senior general	29	13.3	5.1	40.3	8.2

N.B. *= In these classes no tests have been admistered. School means are based on class means. Pre voc= pre vocational edcation; jun general= junior gemeral education; senior general= senior general education; pre uni= pre-university education

Table 2: Average percentages for observation categories, school years 1992-1993 and 1993-1994

	Total		School A (heterogeneous)		School B (tiled-classes)		School C (homogeneous partly tiled)	
	'92-'93	'93-'94	'92-'93	'93-'94	'92-'93	'93-'94	'92-'93	'93-'94
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Teacher behavior								
Reviewing prior knowledge	1.5 (1.9)	0.6 (1.1)	1.6 (2.3)	0.4 (0.6)	0.3 (0.6)	0.2 (0.3)	2.3 (1.9)	1.2 (1.6)
Instruction of new knowledge	25.3 (18.8)	25.0 (18.6)	18.8 (16.2)	15.5 (10.0)	18.8 (20.9)	17.6 (13.9)	36.9 (15.3)	40.0 (19.6)
Guided practice	3.8 (5.3)	3.9 (5.0)	1.9 (2.9)	0.5 (1.0)	4.2 (5.2)	4.4 (5.3)	5.5 (6.9)	6.4 (5.5)
Checking and testing	10.8 (8.7)	8.9 (9.2)	7.6 (7.2)	10.4 (12.5)	13.3 (11.2)	7.8 (7.2)	12.2 (7.9)	8.6 (8.3)
Guiding student-led activities	0.8 (3.5)	1.2 (3.0)	0.1 (0.2)	1.5 (2.8)	0.0 (0.1)	0.5 (1.3)	2.2 (5.7)	1.6 (4.1)
Monitoring and helping seat work	28.9 (21.8)	32.7 (22.8)	37.3 (10.8)	40.2 (9.7)	34.1 (31.3)	42.4 (25.5)	16.3 (16.9)	17.3 (22.2)
Management activities	22.0 (8.3)	20.4 (8.4)	25.5 (7.5)	23.3 (4.9)	17.5 (8.8)	16.9 (8.9)	22.1 (7.7)	20.9 (10.0)
No teaching behavior	6.8 (6.0)	7.0 (5.5)	7.2 (5.0)	7.8 (3.6)	11.8 (7.1)	9.9 (7.8)	2.5 (1.7)	3.6 (2.4)
Students' setting								
Whole-class	54.2 (29.5)	55.2 (30.3)	40.7 (25.3)	36.9 (19.4)	46.7 (36.0)	47.7 (27.7)	73.7 (17.8)	78.1 (27.7)
Group work	1.1 (4.9)	5.5 (11.2)	0.1 (0.3)	11.3 (15.9)	0.2 (0.3)	1.1 (3.3)	2.8 (8.3)	4.3 (9.7)
Individual seatwork	44.7 (30.4)	39.2 (30.3)	59.2 (25.2)	51.7 (32.4)	53.1 (35.8)	51.1 (26.9)	23.6 (19.2)	17.5 (19.4)
Students time-on-task levels								
during whole period	58.5 (13.6)	59.2 (12.8)	56.0 (14.3)	55.7 (12.8)	61.9 (11.0)	62.3 (11.7)	58.4 (14.4)	59.4 (13.1)
during whole class setting	53.2 (16.9)	42.6 (21.4)	50.9 (20.5)	35.7 (16.4)	53.0 (12.8)	40.6 (22.9)	55.4 (15.2)	49.8 (21.7)
during group work	78.2 (11.8)	79.3 (17.3)		72.4 (17.4)			78.2 (11.8)	89.7 (11.2)
during individual seat work	60.4 (20.6)	68.2 (19.3)	55.2 (17.5)	58.5 (21.2)	65.1 (18.3)	75.6 (13.0)	63.4 (25.3)	72.5 (18.1)

Note: n's for school year '92-93: total: n teachers=25; n students=150; A: n teachers=9; n students=54;
B: n teachers=7; n students=42; C: n teachers=9; n students=54;
n's for school year '93-94: total: n teachers=25; n students=150; A: n teachers=8; n students=48;
B: n teachers=8; n students=48; C: n teachers=9; n students=54.

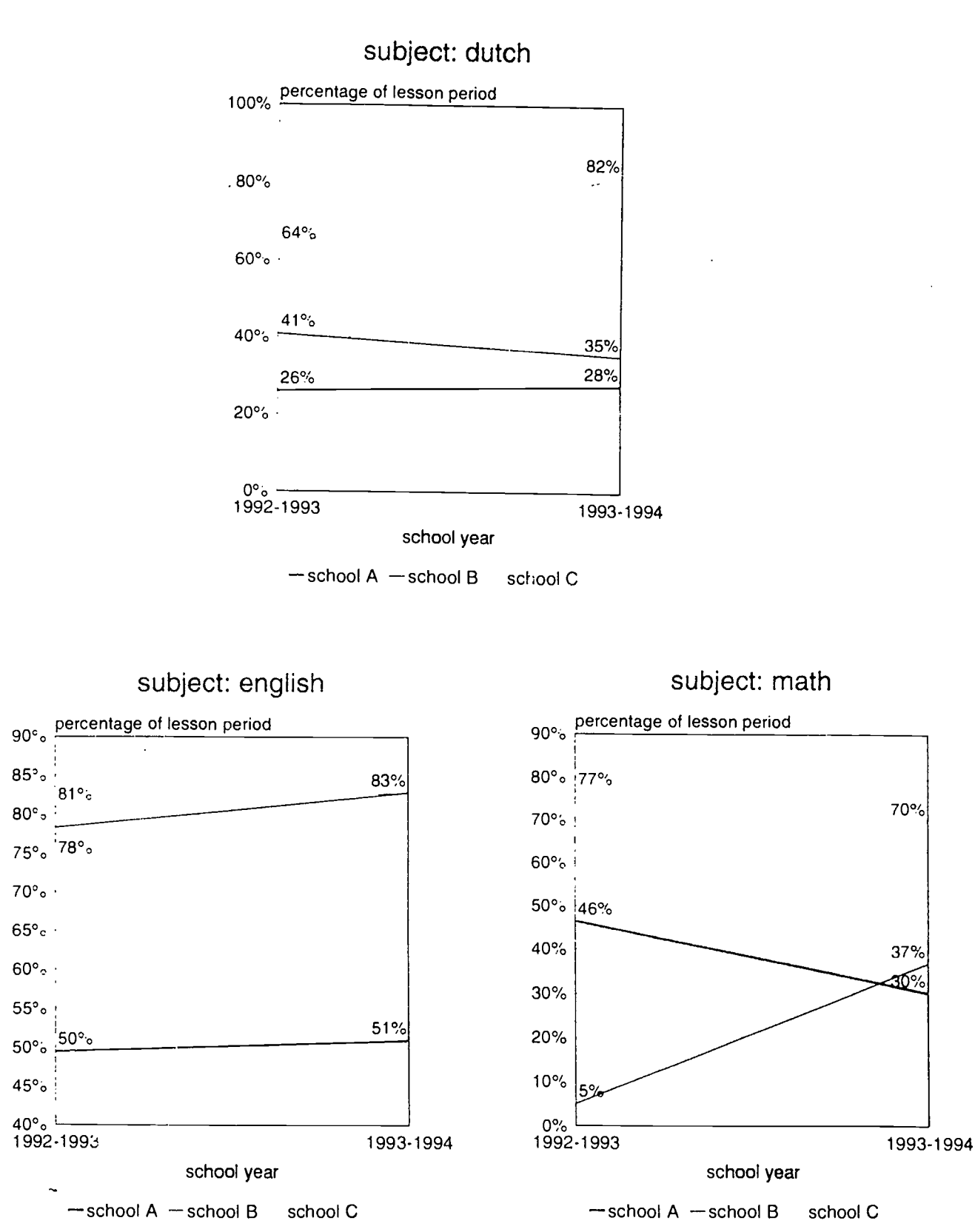


Figure 1: time spent in a whole-class setting by school and subject

Students' settings

Students can spend their time in three kinds of settings: whole-class activities, individual seatwork and group work. In general, students alternately work in whole-class setting and in individual settings. Group work is rarely used. However, in the second year students work more often in groups than in the first year. This is especially the case in school A. During about 7% of the period teachers are *not involved in active teaching behavior.* Instead they may be involved in discussing matters with colleagues, or be engaged in social talk with the students, or in preparing the next lesson and so forth. The three schools show considerable differences in this repect. In school B teachers spend approximately 10% on non-teaching activities while in school C only 3% of the teachers' time is spent in this way.

Comparing the two school years, we may conclude that the picture of the teachers' use of intructional time remains relatively stable.

As the results indicate, there are important differences between schools and subjects in the matter of students' settings. These differences are displayed in figure 1. First we notice a relatively stable difference between schools.

At school C students generally work in a whole-class setting, during between 70% and approximatcly 80% of the lesson period. In schools A and B less time is spent in a whole-class setting. When comparing the subjects, we may conclude that English, which is the most important foreign language used in The Netherlands, is more often taught in a whole-class setting than the other subjects.

As a result of a lack of statistical power changes over the two school years are not significant. However, the most visible changes take place within the subject of math. During the second year at school B students increasingly work in a whole-class setting. In the first years students almost exclusively work in an individual setting.

Time spent in individual settings is almost complimentary to time spent in whole-class settings, so these results do not need further comment.

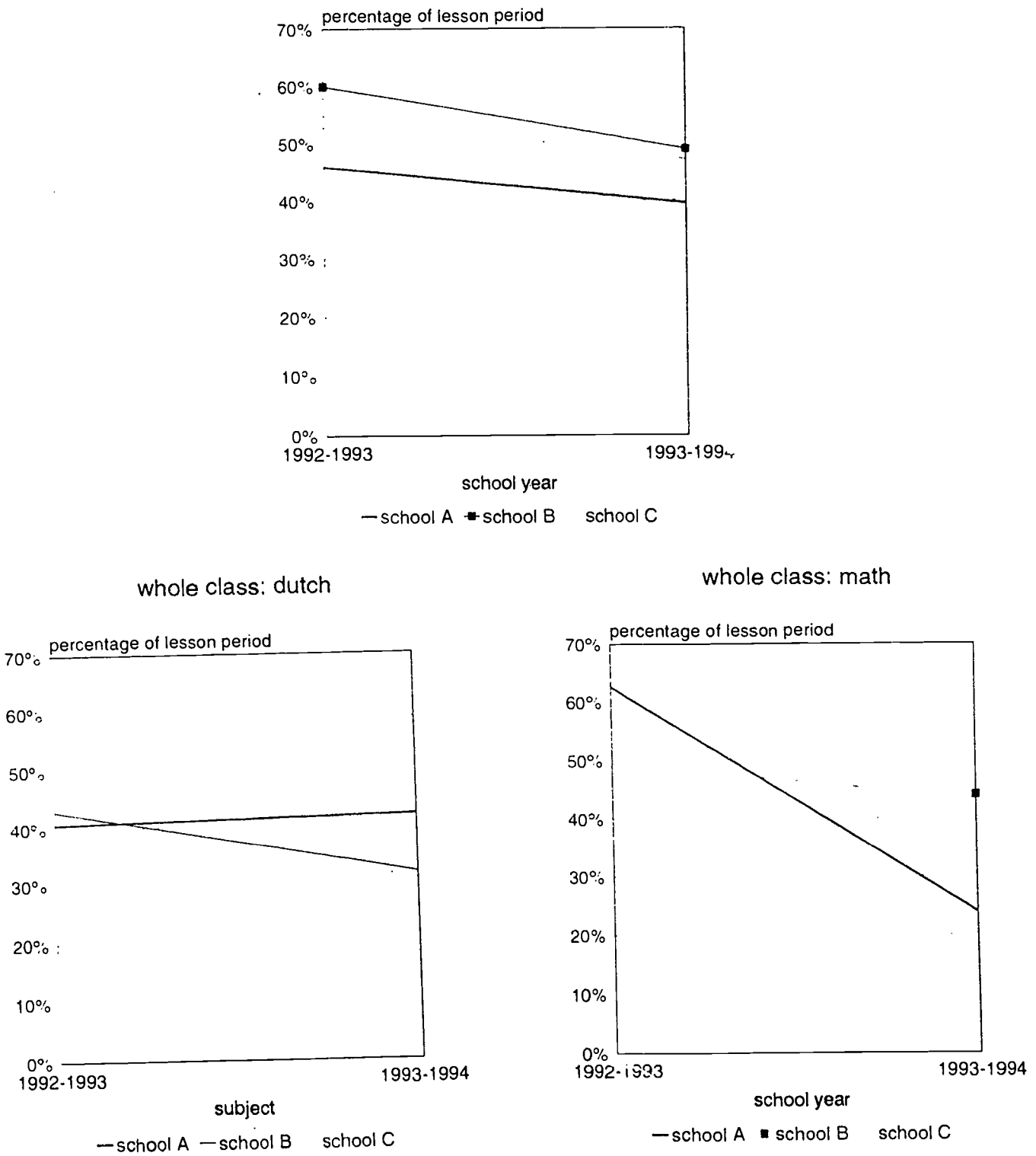
Students' time-on-task levels

Table 2 also presents a picture of students' time-on-task levels during the two school years. Note that these levels concern different groups of students. Since the unit of analysis is the individual student, statistical power is raised to some degree.

On average students spend 59% of their learning time on-task. This percentage varies across schools and subjects. Students in school B (62%) attain higher levels of time-on-task then students in school A (56%) and C (58%).

Students attain a far higher level of on-task behavior when working in groups (almost 80%) than when working in a whole-class setting (53% and 43% for the first and second year respectively). Time on-task-levels (TOT) during individual seatwork is between 60% and 68% for the first and second year respectively. The results also indicate a significant increase in time-on-task levels during individual seat work over the two school years. A similar decrease can be noted in TOT-levels during a whole-class setting.

In figure 2 time-on-task levels for different subjects are compared across schools. In general students display more on-task behavior during math and Dutch lesson periods than during English lesson periods. This can be explained by the fact that activitities during English more often occur in whole-class settings. During those activities more time appears to be lost on management behavior. While working through excercises teachers spend much of their time telling the students what to do, and students spend time following organizational instructions and waiting for academic tasks to be carried out.



Picture 2: time-on-task levels during a whole class setting by school and subject

Academic level and time on-task

In table 3 time-on-task levels during individual seatwork are compared across the variables 'academic level', 'school' and 'school year'. This comparison is made because effects of class heterogeneity are in general clearly noticeable during periods of seatwork. During these periods teachers experience problems adapting to individual students' needs.

First, we notice a lower time-on-task level in the heterogeneously composed classes of school A, compared to schools B and C. Second, in the first school year no clear effect of academic level on TOT-level can be noticed. However, in the second school year, students of intermediate academic level in school A attain lower TOT-levels than their less able peers and, especially, than their more able peers. In school C, the reverse is the case. Medium-ability students reach higher TOT-levels than students of low and high academic levels. This finding reflects a change over the two school years. Finally, no effect of subject was found for TOT-levels during individual seatwork.

Table 3: Average percentages of time on-task during individual seatwork by school and academic level in the school years 1992-1993 and 1993-1994.

	1992-1993			1993-1994		
	Mean	Sd.	n	Mean	Sd.	n
school A: *(heterogeneous)*	55.2	17.5	54	58.6	21.2	48
low	49.9	17.4	18	58.5	22.5	16
middle	59.3	18.0	18	51.5	20.4	16
high	56.5	16.8	18	65.9	19.3	16
school B: *(tiled-classes)*	65.1	18.3	36	75.6	13.0	42
low	63.3	18.3	12	79.1	11.9	14
middle	60.4	16.6	12	74.0	12.8	14
high	71.6	19.5	12	73.9	14.5	14
school C: *(homogeneous/partly tiled classes)*	63.4	25.3	36	72.5	18.1	36
low	62.5	30.3	12	66.0	20.7	12
middle	64.1	25.4	12	80.7	13.9	12
high	63.5	21.7	12	70.8	17.3	12
Total:	60.4	20.5	126	68.2	19.4	126
low	57.3	22.4	42	67.5	20.6	42
middle	61.0	19.6	42	67.3	20.6	42
high	62.8	19.6	42	70.0	17.2	42

Measures to adapt instruction to student needs

Table 4 summarizes the perceived consequences of class heterogeneity. In all three schools teachers indicate that on average four students experience serious problems in carrying out academic tasks. Generally speaking, teachers do not definitely claim loss of learning time

(mean: 2.5, 2.3) as a result of good students ' ving to wait for their less able peers. However at school A (mean: 3.3 over two ye. s) and B (mean: 2.8 over two years) this is (more often than in the other schools) claimed in connection with English lessons. If students have to wait for their peers, this may sometimes be a consequence of classroom composition (mean: 2.4, 2.7), according to the teachers. English teachers indicate this more often than teachers of other subjects (mean: 3.0 over two years). This result is in line with the lower time-on-task levels, as we found in our classroom observations. The organizational problems may be caused by the whole-class nature of English textbooks in the Netherlands. Especially in schools with heterogeneous classes teacher instruction can lead to waiting behavior by good students.

With regard to perceived consequences of class heterogeneity, there are no notable changes over the two school years.

Table 4: perceived consequences of class heterogeneity

	Total (n=25, 23)		School A (heterogeneous) (n=9, 7)		School B (tiled-classes) (n=7, 7)		School C (homogeneous/ partly tiled) (n=9, 9)	
	'92-'93	'93-'94	'92-'93	'93-'94	'92-'93	'93-'94	'92-'93	'93-'94
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Average number of students experiencing serious problems with academic tasks	4.5 (1.2)	3.7 (2.1)	4.7 (0.9)	3.8 (0.8)	4.0 (1.3)	4.2 (1.3)	4.8 (1.6)	3.3 (3.1)
Good students waiting for poor students during instruction?[a]	2.5 (0.8)	2.3 (0.6)	2.5 (0.8)	2.4 (0.9)	2.7 (1.0)	2.2 (0.8)	2.5 (0.8)	2.2 (0.4)
Waiting a consequence of the type of classroom composition?[b]	2.4 (1.3)	2.7 (1.1)	2.5 (1.3)	2.8 (1.1)	2.0 (0.9)	3.0 (0.0)	2.7 (1.2)	2.4 (1.4)

[a] Categories item ranging from 1= never, to 5= always; [b]Categories item ranging from 1= definitely not 5= definitely

Dealing with heterogeneity demands specific instructional measures. In table 5 three measures are mentioned. One of these is to have students work on enrichment tasks. As the table shows, this happens more frequently in school B than in schools A or C. There has been some increase in the use of this measure over the two school years. The same holds true for the use of what are called 'augmentative tasks', which involve students in working on more or less the same tasks in greater depth. Again at school B this measure is more often used than in the other two schools. No changes over the school years can be noted for this type of measure.

The extent to which students are allowed to help poor students differs across schools and subjects. In general this happens more frequently at schools A and B than at school C. More specificly, peer-assistance is more frequently used in math lessons (mean

3.1) than in language lessons (mean 2.1). Again this result is corroborated by the results of the classroom obervations.

The picture concerning the use of measures to adapt to students' differences remains stable over the two school years.

Table 5 also presents results from questions about the perceived ability to adjust instruction to students' individual academic needs. Teachers at school A (with heterogeneous classes) feel relatively qualified to form groups according to achievement levels (mean: 4.2, 3.8). Teachers at school B (tiled classes) and especially at school C (homogeneous classes) feel less capable in this respect.

Table 5 Adjustment to variety of academic needs: measures taken and perceived ability

	Total (n=25, 23)		School A (heterogeneous) (n=9, 7)		School B (tile-classes) (n=7, 7)		School C (homogeneous/partly tiled) (n=9, 9)	
	'92-'93	'93-'94	'92-'93	'93-'94	'92-'93	'93-'94	'92-'93	'93-'94
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Measures taken:								
Number of students working on enrichment tasks	3.1 (4.7)	7.2 (10.5)	2.9 (2.6)	4.0 (3.9)	5.9 (7.5)	17.0 (12.6)	1.2 (2.0)	4.3 (10.9)
Number of students working on augmentative tasks	4.8 (5.6)	8.3 (10.7)	3.7 (4.5)	4.6 (4.2)	9.0 (9.7)	18.8 (11.1)	2.8 (2.3)	5.0 (10.7)
Good students helping less able peers[a]	2.5 (0.8)	2.4 (1.0)	2.5 (0.8)	2.6 (0.9)	2.8 (1.0)	2.7 (1.2)	2.0 (0.0)	2.1 (0.9)
Perceived ability to:								
Form groups according to achievement levels[b]	3.4 (0.7)	3.4 (0.6)	4.2 (0.4)	3.8 (0.4)	3.1 (0.9)	3.3 (0.8)	3.0 (0.0)	3.2 (0.4)
Adapt instruction to individual student needs[b]	3.2 (0.8)	3.2 (0.9)	4.0 (0.0)	3.5 (0.5)	3.1 (0.9)	3.3 (1.0)	2.7 (0.5)	2.9 (0.9)
Spend time on weaker students given organizational constraints[b]	2.7 (0.8)	2.9 (0.8)	3.3 (0.5)	3.2 (0.8)	3.0 (0.8)	3.0 (1.0)	2.1 (0.6)	2.6 (0.7)

[a] Categories item ranging from 1= never, to 5= always; [b]Categories item ranging from 1= very low, to 5= very high

The same picture holds for the extent to which teachers feel capable of adapting instruction to individual students' needs. Teachers in school A consider themselves more capable than teachers at the other schools.

A final question concerns the perceived ability to spend time on weaker students, given certain organizational constraints. Such constraints may differ between schools. Again there is a notable difference between school C and the other schools . At school C

teachers conceive of themselves as less able than their colleagues in the other schools. In general, at all three schools teachers experience some organizational time-limitations on working with weaker students. As regards the ability to adjust instruction to students' individual academic needs, no changes ocurred over the two school years.

6. Discussion

In this study we have attempted to map teacher and student behavior in heterogeneous classes, with special reference to learning-time and instructional time. We started from the assumption that the situational context of a class is an important variable in the ways in which teachers deal with differences between students.

The question of heterogeneity is of particular importance in the Netherland since schools are faced with the task of having to lead students towards a common set of core targets. Given that the time spent in attaining the targets is allowed to vary per student, schools and teachers are faced with the task of having to organize what we have called 'adaptive teaching'. The first two research questions concerned the nature of time-management by teachers and (different types of) students, as well as the relation between time-management and class-heterogeneity. The third question concerned the measures taken by teachers to adjust their teaching behavior to the level of the students, and the fourth question the degree of change which occurred during the early stages of implementation of the core curriculum with regard to the handling of heterogeneity.

If we look at the way teachers spend their time (research question 1) we obtain the following picture. Teachers spend on average more than 70% of their time on actual teaching and more than 20% on classroom-management activities. During the rest of the time they are not involved in teaching activities of any kind. In general the lessons in first-stage classes of secondary education show a pattern which varies between whole-class teaching and individual work. Group work is practically non-existent. The extent to which whole-class or individual work is used varies with class-heterogeneity. We find a dominant learning environment - somewhere in between the extremes of whole-class teaching - for homogeneous classes (school C), and more supervisory forms of teaching for heterogeneous classes (school A). In the latter environment students were often found to work individually. School B, which has 'tiled classes', is somewhere between these extremes. It is possible that the school context, manifested in the school's individual views and policies on heterogeneity, has its effects on teaching behavior. Moreover, the choice of learning environment also appears to be affected by school subject. For example, in comparison with Dutch and math, English is more often taught in a whole-class environment.

The above picture remains fairly stable for the two school years under investigation. At school A we do perceive increased application of group work, but this can be explained in terms of the in-service training the school received on the subject of classroom cooperation.

Students' time-on-task rate (research question 2) is at a relatively low level (58.5%) compared to results from Dutch primary education, which show a percentage of about 70% (Roelofs 1993; Schonewille 1993; Reezigt, de Vries & Weide 1988) and from other studies in secondary education (Herfs et al. 1990), in which we find percentages of approx. 76%. It also appears that levels of on-task behavior varie with the degree of first-stage class heterogeneity (i.e. homogeneous, tiled, heterogeneous), although time-on-task also varies with school subject. The instructional and organizational abilities of the teacher also play a role in this respect, as do the textbooks used. No straightforward relations have

been found over the years between the student ability levels and time-on-task behavior. The effect of ability level interacts with class-heterogeneity. As we saw earlier for 1992-1993, at school A we found a greater degree of *difference* in time-on-task within heterogeneous classes than wtihin homogeneous classes. For 1993-1994 we see a greater degree of on-task behavior for extreme ability-groups at school A, whereas for the homogeneous groups at school C the medium-ability students show the highest degree of on-task behavior. In homogeneous classes lessons are obviously adapted to the average student, whereas lessons for heterogeneous groups show a greater spread in adaptation.

The relation between heterogeneity and time-on-task levels is similar to that found in American studies by Evertson (1980) and Dutch studies by Reezigt et al. (1988).

Another striking aspect of the results is the high percentage of off-task behavior during whole-class teaching, which may be attributed to the high frequency of procedural activities. By contrast, in Dutch primary schools degrees of on-task behavior are related to whole-class learning environments. Perhaps the difference has to do with the system of 50-minute timetables utilized in Dutch secondary education and the fact that this system leads to a relatively large amount of transition time. Students repeatedly have to 'settle' into a new class-setting. We have no explanation for the decrease in task-orientation for whole-class settings over the two school years.

Apart from the analysis of actual time-use we investigated what measures, if any, teachers claim to take in the adaptation to student levels (research question 3). The first conclusion is that heterogeneity seems to be a relative concept. Even in working with homogeneous classes (school C) teachers experience approximately the same number of 'problem students' as their colleagues in heterogeneous classes (school A). Furthermore, despite differences in class-composition, the effects of differences in level are not assessed differently for the three schools.

On average teachers take few differentiating measures in their instruction or their supervision of assignments, such as giving enriched or augmentative tasks and allowing weaker students to be helped by better students. This picture hardly varies with class-heterogeneity, although some increase in the use of enriching and augmentative assignments can be seen for the first year of core curriculum implementation.

On the other hand teachers do collect sufficient data which could serve as a basis for differentiation. Supplementary data show that grade-lists and other records of students' progress are regularly maintained. From the observations it is already clear that teachers spend a considerable part of their lessons on checking and assessing their students' progress.

The three schools differ in the matter of registering differences between students and applying adaptive instruction and supervision. At school A, with heterogeneous first-stage classes, teachers felt best able to do this. At school C, with homogeneous first-stage classes, teachers were doubtful about their ability to apply adaptive measures. This picture remains constant for the first year of core curriculum implementation.

It is interesting to note that observed teachers in all schools felt somewhat restricted in focusing special attention on weaker students by the prevailing structures of class- and school-organization. In some cases these perceived restrictions might be related to class-size. For example, the larger classes at school C (with an average of 28 students) offer fewer possibilities for differentiation than the smaller classes at school A (with an average of 21). In other cases the perceptions might be related to the methods used by the relevant schools with regard to differentiation and individualization, although these methods are not clear from the research data.

What insights does the present study yield as regards the way heterogeneity was handled during the implementation of the core curriculum? Do the results allow us to take stock? The following is an attempt to extrapolate, on the basis of the present research, some potential trends concerning the matter of class-heterogeneity.

For individual learning-tracks to become viable in the future, teachers will have to adapt their teaching behavior in the core curriculum. One year after the introduction of this large-scale innovation we may conclude that there has been little change at two of the three participating schools. At the school with heterogeneous first-stage classes some developments are visible, the most striking feature being an increase in attention to cooperative learning. Application of this method of working allows weaker students to learn from their more gifted peers.

A number of findings are generally relevant to methods of dealing with heterogeneity. First, the finding that learning-time is more easily effected in heterogenous groups than in relatively homogeneous groups, which supports the results of previous research into class-heterogeneity (Evertson 1981). It is precisely in a heterogeneous context that optimal class-organization and the correct adaptation of learning assignments to the level of students become important.

We may also conclude that, in view of the low level, all types of students may profit considerably from increased task-orientation. The greatest loss occurs during whole-class episodes: starting and finishing the lesson, and explaining task procedures in class-time. Combining lessons by way of double periods or half-day shifts might also create considerably improved conditions. In addition, a greater portion of lesson time could be spent on individualized learning activities, with the students themselves being responsible for their own activities. Such solutions do of course presuppose excellent class-organization. It is not impossible that the low percentage of task-orientation (i.e. 58%) as a general phenomenon is related to large-sized combined schools in the Netherlands, as a result of greater loss of time during classroom changes. This explanation would have to be tested in follow-up research.

Another notable result is that teachers do collect many data about students, but that these data are used for assessing students rather than for the implementation of adaptive measures. In this connection, the present results support the Dutch results of Van der Werf and Driessen's (1993). Here too it might be the case that the system of frequent classroom changes and relatively short periods of contact restricts the potential for differentiation. This could provide a handle on possible changes in this respect.

We would like to finish our paper by drawing attention to some limitations of the present research which have to be taken into account in interpreting the results. First, we may question the measure of heterogeneity that was selected. Since we provide a picture of the developments in three schools, the type of first-stage class selected by the schools was used as a measure of heterogeneity. The problem with this approach is not that the distinction per se is invalid as a measure, given the fact that this particular classification is confirmed by the test results. Rather, the problem lies in the fact that information was lost concerning the educational type of class (for example, the distinction between pre-vocational and junior general secondary, or between senior general secondary and pre-university types of education). A larger sample might have allowed us to use finer distinctions, perhaps independently of the classification used by the schools.

The second limitation on the present research concerns the fact that textbooks have not been included as variables. The interactions that were found between school and school subject might be explained by differences in the textbooks used. It is known, for

example, that teachers in the Netherlands allow their teaching behavior to be strongly influenced by the textbooks they use. In this connection we mentioned the whole-class characteristics of the textbooks used for English, which might leave little room for differentiation. At present textbook analysis is being carried out at three schools. At a later stage the results of this analysis will be related to the present observational data. First findings would appear to indicate that teachers adapt their teaching behavior only as far as the textbooks allow.

Loss of teachers, particularly at schools B and C in our sample, is an additional problem for interpreting the research results, in that the validity of longitudinal comparisons becomes problematic. Pooled data were used from two school years, with the school year as variable. In two respects the loss of teachers may have been selective. For example, the teachers who left experienced a greater number of students with problems during the first school year than those who stayed. In addition, those who stayed observed in their classes that the better students had to wait more often for their weaker peers. However, longitudinal analyses of incumbent teachers did not yield any different results.

Summing up, we conclude that the sample used in our research is not representative for the combined-school population in the Netherlands since it only concerns broadly-based combined schools. However, in order to provide an in-depth analysis of the core curriculum implementation process we deliberately selected those broadly-based combined schools which, as regards vision, ideological identity and educational policy differed as widely as possible. This variation in school characteristics could yield much information about and insight into, innovative processes. One disadvantage of the variation, however, is that the effects of heterogeneity cannot be totally separated from the other school characteristics mentioned earlier. As a result no general conclusions can be drawn from these results, although the data partly support the Dutch questionnaire survey carried out by Van der Werf and Driessen (1993). Both studies indicate that teachers hardly differentiate in secondary education first-stage classes. In order to provide a more conclusive picture measurements would have to be repeated in the coming years to make visible any trends that might exist in ways of dealing with heterogeneity.

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Note

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